

## Evaluation of lisianthus (*Eustoma grandiflorum*) cultivars for growth and floral attributes under High Altitude and Tribal zone of Andhra Pradesh

Chetti Bindhu\* and Vavilapalli Sivakumar

Horticultural Research Station, Dr. YSR Horticultural University, Chintapalli- 531 111, Andhra Pradesh

\*Email : bindhuchetti007@gmail.com

Receipt : 22.09.2023 ; Revised : 11.01.2024 ; Acceptance : 14.01.2024

DOI : 10.53552/ijmfmap.10.1.2024.63-67

License : CC BY-NC 4.0

Copyright : © The Author(s)

### ABSTRACT

A field experiment was conducted to study the evaluation of Lisianthus cultivars under polyhouse conditions for different growth and floral attributes in the high altitude and tribal zone of Andhra Pradesh at Horticultural Research Station, Dr YSR Horticultural University, Chintapalli, Alluri Seetharamaraju District, Andhra Pradesh during early summer of 2023. Six lisianthus cultivars Viz., Rosita 3 Blue Picotee Ver-2, Rosita 4 Pure White, Excalibur 3 Blue Picotee, Rosita 3 Pink Picotee, Rosita 4 Green and Rosita 3 Blue were utilized in the experiment. Among the cultivars, plant height (104.30cm), number of leaves (55.40), number of shoots per plant (5.0) was the highest in Rosita 4 Pure White and internodal length (9.80 cm) was highest in Rosita 3 Blue PicoteeVer- 2, whereas days taken to flower bud initiation (51.80) was the lowest in Rosita 3 Blue and days taken to flower bud initiation to flower opening (13.40) was lowest in Rosita 4 Pure White. Number of flowers per plant (16.80) and number of petals per flower (18.00) were highest in Rosita 4 Pure White. Bud diameter (5.88 cm) and flower diameter (21.20) were highest in Rosita 4 Green, whereas bud length (4.42 cm) and flower length (4.72 cm) were highest in Rosita 3 Blue PicoteeVer- 2.

**Keywords:** Eastern ghats, high altitude, lisianthus, performance, tribal zone

### INTRODUCTION

Lisianthus (*Eustoma grandiflorum*), commonly called prairie gentian is a member of the family Gentianaceae and is a high-end ornamental cut flower native to warm regions of Northern-South America, Southern-United States, Mexico and the Caribbean islands. Lisianthus is a herbaceous annual growing to 15 to 60 cm tall, with bluish-green, slightly succulent leaves. They possess large funnel-shaped flowers that grows on long straight stems, or branching stems that can grow up to eighteen feet tall. Flowers can grow up to two inches and which are found in a varied colour. Lisianthus are long-stemmed flowers in cymes, with often only a few openings at a time. Sepals on lisianthus are only fused close to the base and are much smaller than petals (Namratha *et al.*, 2021).

Lisianthus crop requires a moderate climate and is cultivated at an altitude range of 1,000-1,800 m above MSL and optimum day night temperatures between 20-24°C and 16-18°C respectively. The optimal light levels for lisianthus flowers are 4,000

to 6,000 ft candles. Plants show rosetting if the temperatures are high during seedling up to 3 pairs of leaves (Harbaugh *et al.*, 2000, Ahmad *et al.*, 2017). It is a moderately cold-tolerant annual or biennial plant. Conventionally, it is propagated vegetatively by cuttings and sexually by seeds (Mousavi *et al.*, 2012a; Rezaee *et al.*, 2012; Uddin *et al.*, 2017). Lisianthus is generally a slow growing plant, requiring 5 to 6 months from sowing to flowering (Uddin *et al.*, 2013). Reeta *et al.* (2020) suggested that pinching and one to two layers of support netting are required for production of quality flowers in lisianthus.

Lisianthus crop is gaining immense popularity in the floriculture sector worldwide for its thornless rose like appearance and good post-harvest life. These flowers are excellent cut flowers and available in a large range of colours like white, blue, purple, pink and bicolor. Production of lisianthus cut flower industry has risen tremendously in recent years. Spain, Holland, Italy, France and Portugal are the main lisianthus producing countries

(Namesny, 2005 ;Anitha *et al.*, 2019). It is one of the new flower species that is brought to the world market and more recently introduced to the Indian market (Reeta *et al.*, 2020). In European and Asian markets it is already listed among the top selling cut flowers.

The performance of cultivars modifies with the region, season and cultivars, hence it is necessary to evaluate cultivars for their suitability and adaptability regarding growth and floral parameters. There is enormous potential for the production of new flower crops in the High Altitude and Tribal (HAT) zone that comes under the Eastern Ghats region of Andhra Pradesh due to its distinct climatic range which is adequate to grow lisianthus crop. Identification, introduction and evaluation of vital cut flower like lisianthus required to improve the trade and livelihood of the tribal communities of this region. Up to now, no attempt was made on the evaluation of lisianthus genotypes under the Eastern Ghats region conditions of Andhra Pradesh. By observing these conditions, a field experiment was initiated to select suitable lisianthus cultivars for the HAT zone of Andhra Pradesh.

## **MATERIALS AND METHODS**

A field experiment was conducted at Horticultural Research Station, Dr YSR Horticultural University, Chintapalli, Andhra Pradesh during the period from March 2023 to June 2023 under polyhouse conditions to evaluate different cultivars of lisianthus. The location falls under the Agro-climatic zone of High Altitude and Tribal Zone with an average annual rainfall from South-West monsoon of more than 1300 mm, a maximum temperature range of 17 to 35 °C, a minimum temperature range from 5 °C to 24°C and is located at an altitude of 933 m MSL. The geographical situation is 170.13' N latitude and 840.33' E longitude (Sivakumar *et al.*, 2020). The experiment was laid out in Randomised Block Design with 6 cultivars and 4 replications. Six cultivars of lisianthus seedlings were planted in the main field under a naturally ventilated polyhouse and irrigated at regular intervals. Plant protection measures were taken on a need basis to maintain healthy crop. The experimental field was brought to fine tilth and made into raised beds of 1m width and 4.5 m length to raise each cultivar. Well

decomposed farm yard manure was mixed with soil before planting. Six cultivars of lisianthus namely Rosita 3 Blue Picotee Ver-2, Rosita 4 Pure White, Excalibur 3 Blue Picotee, Rosita 3 Pink Picotee, Rosita 4 Green and Rosita 3 Blue were planted at a spacing of 15 cm between rows and 10 cm between plants.

Data on growth parameters *viz.*, plant height (cm), number of leaves per plant, number of shoots per plant, internodal length (cm) and floral parameters *viz.*, days taken to flower bud initiation, days taken to flower bud initiation to flower opening, flower bud diameter (cm). flower bud length (cm), number of flowers per plant, number of petals per flower, flower head diameter (cm), flower length (cm) and vase life (days) were collected to compare the performance of the cultivars.

## **RESULTS AND DISCUSSION**

**Growth parameters:** The mean performance for growth parameters showed variation among the cultivars and is given in Table I. The lisianthus cultivars showed significant difference with respect to all growth parameters except the days taken from flower bud initiation to flower opening.

**Plant height (cm) :** The maximum plant height was observed in Rosita 4 Pure white (104.30cm), followed by Rosita 3 Blue Picotee Ver- 2 (96.20 cm) and the minimum plant height was observed in Rosita 4 Green (78.1 cm). Genotype and environmental factors plays an important role to regulate plant height along with it's overall performance. Uddin *et al.* (2013) stated that plant height of lisianthus is genetically controlled. Similar findings were reported in Bhargav *et al.* (2020) and Ahmad *et al.* (2017); Anitha *et al.* (2019) and Namratha *et al.* (2021).

**Number of leaves per plant:** The maximum number of leaves was observed in Rosita 4 Pure white (55.40 cm), followed by Rosita 3 Pink Picotee (45.40cm). Namratha *et al.* (2021) stated that the leaves are the functional unit of photosynthesis, which greatly influenced the growth and flower yield of the crop. Lisianthus shows variations in number of leaves among cultivars which is also observed by Ahmad *et al.* (2017); Anitha *et al.* (2019); Bhargav *et al.* (2020) and Namratha *et al.*, (2021).

**Table 1: Performance of lisianthus cultivars for growth attributes under high altitude zone Andhra Pradesh**

Cultivar	Plant height (cm)	No of leaves per plant	Number of shoots per stem	Internodal length (cm)	Days taken to flower bud initiation	Days taken to flower bud initiation to flower opening
Rosita 3 Blue PicoteeVer- 2	96.20	32.40	4.20	9.80	56.20	13.80
Excalibur 3 Blue Picottee	80.60	32.40	3.20	9.60	56.00	14.60
Rosita 4 Pure White	104.30	55.40	5.00	8.40	61.20	13.40
Rosita 3 Pink Picotee	95.70	45.40	4.00	7.80	55.20	13.60
Rosita 4 Green	78.10	25.80	1.60	8.80	54.40	14.20
Rosita 3 Blue	86.00	35.20	3.00	9.64	51.80	14.40
C.D.	8.84	9.16	2.01	1.24	2.11	NS
<b>SE(m)</b>	<b>2.98</b>	<b>3.09</b>	<b>0.68</b>	<b>0.42</b>	<b>0.71</b>	<b>0.41</b>
<b>C.V.</b>	<b>7.38</b>	<b>18.26</b>	<b>43.24</b>	<b>10.33</b>	<b>2.85</b>	<b>6.47</b>

**Table 2: Performance of lisianthus cultivars for floral attributes under high altitude zone of Andhra Pradesh**

Cultivar	Number of flowers per stem	No of petals / flower	Bud diameter (cm)	Bud Length (cm)	Flower length (cm)	Flower diameter (cm)	Vase life of flowers (days)
Rosita 3 Blue PicoteeVer- 2	6.00	16.40	5.64	4.42	4.72	18.90	13.80
Excalibur 3 Blue Picottee	5.40	15.20	4.64	3.80	4.24	17.50	10.00
Rosita 4 Pure White	16.80	18.00	5.48	3.50	4.06	19.80	14.60
Rosita 3 Pink Picotee	8.60	12.00	4.64	3.70	4.26	17.60	11.20
Rosita 4 Green	2.80	15.60	5.88	3.58	4.12	21.20	12.80
Rosita 3 Blue	5.60	15.80	5.60	3.60	4.12	19.00	11.60
<b>C.D.</b>	<b>4.80</b>	<b>1.53</b>	<b>0.56</b>	<b>0.37</b>	<b>NS</b>	<b>1.32</b>	<b>1.51</b>
<b>SE(m)</b>	<b>1.62</b>	<b>0.51</b>	<b>0.19</b>	<b>0.13</b>	<b>0.18</b>	<b>0.44</b>	<b>0.50</b>
<b>C.V.</b>	<b>47.96</b>	<b>7.42</b>	<b>7.92</b>	<b>7.47</b>	<b>9.25</b>	<b>5.21</b>	<b>9.21</b>

**No of shoots per stem :** The highest number of shoots was observed in Rosita 4 Pure white (5.00), followed by Rosita 3 Blue PicoteeVer- 2 (4.20). Namratha *et al.*(2021) stated that variation for number of shoots per stem may be due to genetic behaviour of the cultivar and increased number of branches leads to production of more number of leaves in turn it will enhance the yield of flowers. The results are in line of confirmation with Uddin *et al.* (2015) ; Ahmad *et al.* (2017) and Namratha *et al.* (2021).

**Internodal length (cm) :** Longest Internodal length was observed in Rosita 3 Blue PicoteeVer- 2 (9.80 cm) followed by Rosita 3 Blue (9.64 cm).Namratha *et al.* (2021) stated that the variation in internodal length among the cultivars may be under genetic control and added that higher the internodal length more will be the plant height.

Anitha *et al.* (2019) and Namratha *et al.* (2021) also reported similar results.

**Days taken to Flower bud initiation:** Significant variation was observed in case of days required for flower bud initiation among different lisianthus cultivars. Minimum number of days taken to flower bud initiation was noticed in Rosita 3 Blue (51.80) followed by Rosita 4 Green (54.40). Wazir (2014) observed similar variation in days to visible flower bud and stated that these variations were primarily controlled by genotype which is also supported by Uddin *et al.* (2015) and Ahmad *et al.* (2017). Lines that produce early flowering bud can be sorted as early lines and the others as late (Ahmad *et al.*, 2017).

**Days taken to Flower bud initiation to flower opening:** Variation was observed for days taken to flower bud initiation to flower opening among

different cultivars. The minimum number of days taken to flower bud initiation to flower opening was noticed in Rosita 4 Pure white (13.40) followed by Rosita 3 Pink Picotee (13.60) and maximum was observed in Excalibur 3 Blue picotee (14.6). Similar findings were also observed by Wazir (2014) and Ahmad *et al.* (2017).

**Floral parameters:** The performance for floral parameters showed variation within the cultivars and are shown in Table 2. Significant difference was observed in all floral parameters excluding flower length among the *lisianthus* cultivars studied.

**Number of flowers per stem :** *Lisianthus* exhibited significant variation in case of number of flowers per stem. Highest number of flowers per plant was observed in Rosita 4 Pure white (16.80) followed by Rosita 3 Blue PicoteeVer- 2 (6.00) whereas lowest was observed in Rosita 4 Green (2.80). Ahmad *et al.* (2017) stated that variation in flower number is controlled by genotype. Similar variation in number of flowers per stem was observed by Uddin *et al.* (2015); Ahmad *et al.* (2017); Namratha *et al.* (2021) and Anitha *et al.* (2019).

**No of petals per flower :** Variation regarding number of petals per flower was observed among different cultivars of *Lisianthus*. Number of petals per flower was highest in Rosita 3 Blue PicoteeVer- 2 (16.4) and lowest was recorded in Rosita 3 Pink picotee (12.00). Ahmad *et al.* (2017) also observed similar variation and stated that *Lisianthus* lines are classified into single and double according to the number of petals in flower. Uddin *et al.* (2015) stated that petal number varied significantly among *lisianthus* lines.

**Bud diameter (cm):** Significant variation in case of bud diameter was recorded in *lisianthus*. Flower bud diameter was observed highest value in Rosita 4 Green (5.88 cm) and lowest value in Rosita 3 Pink picotee and Excalibur 3 Blue picotee (4.64 cm). Similar variation was observed by Namratha *et al.*, (2021).

**Flower head diameter (cm):** *Lisianthus* cultivars expressed significant variation in case of flower head diameter among different cultivars of *Lisianthus*. The maximum flower head diameter was observed in Rosita 4 Green (21.20 cm) and

the minimum was observed in Excalibur 3 Blue picotee (17.5 cm). Similar variation in flower head diameter was also observed by Harbaugh *et al.* (2000), Wazir (2014) and Uddin *et al.* (2015); Ahmad *et al.* (2017); Namratha *et al.* (2021) and Anitha *et al.* (2019).

**Bud Length (cm):** Variation was observed in case of flower bud length in *lisianthus* cultivars. Flower bud length was observed highest in Rosita 3 Blue PicoteeVer- 2 (4.42 cm) and lowest was observed in Rosita 4 Pure white (3.5 cm). Similar findings were observed in *lisianthus* conducted by Anitha *et al.* (2019).

**Flower length (cm):** Variation was observed in case of flower length in *lisianthus* cultivars. Flower length was observed highest in Rosita 3 Blue PicoteeVer- 2 (4.72 cm) and lowest was observed in Rosita 4 Pure white (4.06 cm). Similar variation was observed in *lisianthus* by Anitha *et al.* (2019).

**Vase life of flowers (days):** The postharvest life of *Eustoma grandiflorum* cut flower is limited by poor bud opening and bent neck in open flowers (Farnaz *et al.*, 2014). The vase life of the inflorescence was considered terminated when 50% of the open florets had wilted (Cho *et al.*, 2001). *Lisianthus* showed significant variation in vase life among the cultivars under study. Maximum vase life was recorded by Rosita 4 Pure white (14.60 days) and minimum was recorded by Excalibur 3 Blue Picotee (10.00 days). Similar variation in vase life among different *lisianthus* cultivars was also reported by Uddin *et al.* (2013); Ahmad *et al.* (2017); Anitha *et al.* (2019) and Bhargav *et al.* (2020).

From the present study, it can be assumed that among the cultivars, Rosita 4 Pure White followed by Rosita 3 Blue PicoteeVer- 2 have performed well under polyhouse conditions of High Altitude and Tribal zone of Andhra Pradesh in view of cut flower attributes like plant height, number of shoots per plant, simultaneous flowering and good vase life. Therefore, it can be popularised for cut flower production under protected conditions in this region. However, further authentication regarding various aspects like yield parameters and standardization of cultural practices in this region may be required for confirmation.

**CONFLICT OF INTEREST STATEMENT**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**REFERENCES :**

- Ahmad, H, Rahul, S.K., Mahbuba, S., Jahan, M.R. and Jamaluddin, A F M. 2017. Evaluation of Lisianthus (*Eustoma grandiflorum*) lines for commercial production in Bangladesh. *International Journal of Business, Social and Scientific Research*, **5**(4):156-167.
- Anitha, K., Selvaraj, N., Jegadeeswari, V. and Sharathkumar, M. 2019. Performance evaluation of lisianthus [*Eustoma grandiflorum* (Raf.) Shinn.] cultivars as an emerging cut flower under Nilgiri conditions. *Proceedings of the III International Symposium on Underutilized Plant Species August 5-8, 2015. ISHS. Acta Horticulturae*, 293-298
- BhargavLakeyi, Devi Singh and Urfifatmi 2020. Varietal evaluation of lisianthus (*Eustoma grandiflorum*) under naturally ventilated polyhouse conditions in prayagraj. *International Journal of Current Microbiology and Applied Sciences*, **9**(12): 16-18.
- Cho, M S., Celikel, F., Dodge, L. and Reid, M S. 2001. Sucrose enhances the postharvest quality of cut flowers of *Eustoma grandiflorum* (Raf.) Shinn. *Proceedings of VII International Symposium on Postharvest, Acta Horticulture*, **543**
- Farnaz Sheikh, SeyedHosseinNeamati, Navid Vahdati and Ali Dolatkahi. 2014. Study on Effects of Ascorbic Acid and Citric Acid on Vase Life of Cut Lisianthus (*Eustoma grandiflorum* 'Mariachi Blue'). *Journal of Ornamental Plants*, December **4**(4): 57-64
- Harbaugh, B.K., Bell, M.L. and Liang, R. 2000. Evaluation of forty-seven cultivars of lisianthus as cut flowers. *Hort. Technology*, **10**(4):812-815.
- Mousavi, E. S., Behbahani, M., Hadavi, E. and Miri, S. M. 2012a. Callus induction and plant regeneration in lisianthus (*Eustoma grandiflorum*). *Trakia Journal of Sciences*, **10**(1):22-25.
- Namratha, G., Chandrashekar, S.Y., HemlaNaik, B., Shivaprasad, M. and Hanumantharaya, L. 2021. Varietal evaluation of Lisianthus (*Eustoma grandiflorum* Shinn.) for morphological parameters under protected cultivation. *The Pharma Innovation Journal*, **10**(12): 2160-2162.
- Reeta, B, Dey, S. S. and Rajkumar. 2020. Lisianthus: New cut flower crop for mid Himalayan Region. *Indian Horticulture*, Sept- Oct: pp. 16-19
- Rezaee, F., Ghanati, F. and Boroujeni, Y L. 2012. Micropropagation of Lisianthus (*Eustoma grandifloram* L.) from different explants to flowering onset. *Iranian Journal of Plant Physiology*, **3**(1): 583 -587.
- Sivakumar, V., Ravindrakumar, K., Chandrasekharrao, C. and Bhagavan, B. V/ K. 2020. Character association and path coefficient analysis studies on yield and yield attributing characters in turmeric (*Curcuma longa* L.). *International Journal of Chemical Studies*, **8**(6):2587-2589.
- Uddin, A. F. M. Jamal, Islam, M. S., Mehraj, H., Roni, M.Z.K. and Shahrin, S. 2013. An evaluation of some japaneselisianthus (*Eustoma grandiflorum*) varieties grown in Bangladesh. *The Agriculture*, **11**(1): 56-60.
- Uddin, A. F. M. Jamal, Rahaman, Sk. S., Ahmad, H., Parvin, S. and Momena, K. 2017. *In vitro* regeneration of lisianthus (*Eustoma grandiflorum* Grise). *International Journal of Business, Social and Scientific Research*, **5**(2): 126-135
- Uddin, A. F. M. Jamal, Roni, M. Z. K., Islam, M. S., Ona, A F., Sarker, M. S. and Shimasaki, K. 2015. Study on growth, flowering and seed production of eight nandini (*Eustoma grandiflorum*) varieties. *International Journal of Business, Social and Scientific Research*, **3**(1): 25-29.
- Wazir, J. S. 2014. Evaluation of lisianthus cultivars for assessing their suitability as prominent new cut flower crop under mid hill conditions of H.P. *International Journal of Agricultural Sciences and Veterinary Medicine*, **2**(1): 105-110.